Verification and Validation of an Innovative Inflatable Structure, Phase II

Completed Technology Project (2011 - 2012)

Project Introduction

An inflatable habitat is a pressure vessel with flexible shell. Notable features such as low weight, large inflated operational volume, and small pre-deployment volume offer significant advantages over traditional rigid metallic and composite habitat structures. Conventional designs suffer from indeterminacy of load sharing between meridional and circumferential members as well as the internally rigid metal support structure. The designs must functionally index the meridional and circumferential members to one another to minimize sensitivity to manufacturing, handling and operational trauma, all the while maintaining their independent load carrying roles. This design process results in oversized members to account for load uncertainties and substantially increases the handling, manufacturing, and integration risks. The unique Ultra High Performance Vessel (UHPV) technology provides the solution to the design and manufacture of robust inflatable structures with exceptional accuracy and dimensional stability. UHPV technology provides high shell load containment architecture with fully determinate load pathways that can be modeled mathematically. The lightweight, low cost inflatable fabric structure, consisting of barrier film layers, carrier cloth containment layers, and pressure restraint tendons can be designed and fabricated to provide an accurate geometry without the need for an internal skeletal frame. Eliminating the need for a rigid internal load-bearing frame allows the collapsed inflatable to be packaged in the smallest possible volume. To bring this innovative inflatable design to use for surface habitats, airlocks and myriad other space environment and containment applications, a verification and validation plan using both testing and predictive analytical models is proposed to conclusively demonstrate that the fully load-determinate UHPV can meet all structural design requirements thereby allowing for decreased mass and risk.

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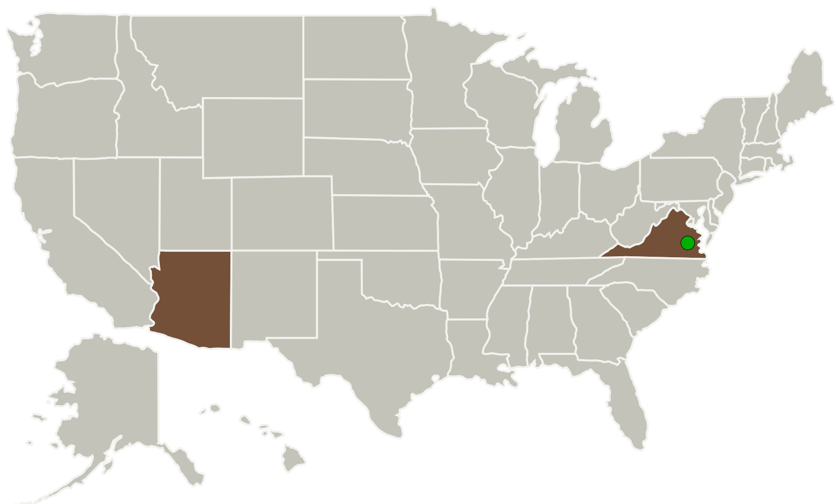
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Arizona	Virginia

Project Transitions

June 2011: Project Start

November 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139540)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Paragon Space Development Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

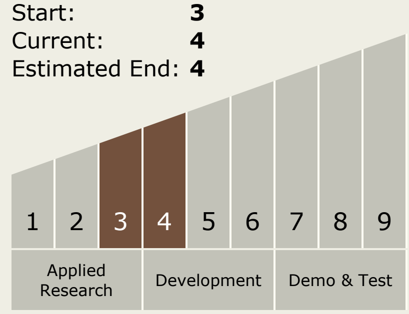
Carlos Torrez

Principal Investigator:

Grant A Anderson

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  └ TX12.3 Mechanical Systems
    └ TX12.3.5 Certification Methods

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System